

# Interoffice Memo

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ENVIRONMENTAL SYSTEMS

DATE 8 May 1986

TO Werner Furth

CC S. Campbell, N. Pfeffer, A. Turowski

FROM R. Di Martino *RD*

SUBJECT Assessment of Usage and Emissions of Perchloroethylene and Trichloroethylene at Energy Systems

On 26 February 1986, perchloroethylene (PERC) and trichloroethylene (TCE) were listed by the U.S. EPA as regulated substances under the National Emission Standard for Hazardous Air Pollutants. We are in the process of determining how much PERC and TCE are used and emitted to the atmosphere as a result of the various operations at Energy Systems and comparing the findings with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA specifies that the National Response Center should be notified if more than 1 pound of PERC or more than 1,000 pounds of TCE are released in any 24-hour period. Our findings thus far are attached.

The major users and emitters of PERC throughout the facility are Y12 with 3,600 lb/day, K25 with 100 lbs/day and X10 with 60 lb/day. By comparison, a single dry cleaning operation emits about 30 lb/day of PERC. Energy Systems is also responsible for a moderate amount of TCE at Paducah--about 60 lb/day, partly emitted as vapor and partly disposed of as sludge. Vapor emission control measures are primarily limited to the use of chiller zones above the degreaser tanks to condense some of the solvent.

Energy Systems' contribution to nationwide emissions of TCE is relatively small, or about 0.022%. Energy Systems' contribution to nationwide emissions of PERC is about 0.126%, a considerable fraction of the nationwide total.

## APPROVAL FOR RELEASE

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Date

Title/Subject DiMartino to W. Furth, "Assessment of  
Usage and Emissions of Perchloroethylene and  
... at Energy Systems; and 6-page rpt (same title)

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*Kevin Stuart*  
K-25 Classification & Information Control Officer

*1/29/87*  
Date

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ASSESSMENT OF USAGE AND EMISSIONS OF PERCHLOROETHYLENE  
AND TRICHLOROETHYLENE AT ENERGY SYSTEMS

A. INTRODUCTION

In response to the EPA Notices of Intent to List perchloroethylene (PERC) (26 December 1985, 50 FR 52880) and trichloroethylene (TCE) (23 December 1985, 50 FR 52422) as potentially toxic air pollutants, an assessment was made to determine the annual usage of these two compounds at Martin Marietta Energy Systems. On 26 February 1986 both compounds were listed as regulated substances under the National Emission Standard for Hazardous Air Pollutants. Specific emission standards for these solvents, both of which are suspected human carcinogens, are likely to follow in the next year.

PERC is widely used as a solvent in dry cleaning and metal degreasing operations and as an intermediate in chlorofluorocarbon (CFC) production. TCE is used as a metal degreaser, as a secondary solvent in adhesives and paints, and in the production of polyvinylchloride. Most losses of both PERC and TCE are to the atmosphere through volatilization. In the atmosphere both compounds are subjected to photochemical degradation, the by-products of which include dichloroacetyl chloride and phosgene.

Due to environmental and health concerns and to market factors such as increased replacement of metals by plastics and substitution of methyl chloroform and other solvents for TCE, production of TCE has declined from a peak of 277,000 megagrams per year (Mg/yr) in 1970 to 65,700 Mg/yr in 1983 (50 FR 52422).

PERC, on the other hand, has chemical and physical properties which make it the most desirable solvent available for the dry cleaning of fabrics. There are no known substitutes available that combine the low fire hazard, the desirable solvent properties and the low acute toxicity levels of PERC. Production was estimated at 320,000 Mg/yr in 1978 and 249,000 Mg/yr in 1983 (50 FR 52880).

Based on EPA estimates for 1983, summaries of uses and source emissions for PERC and TCE are presented in Tables 1 and 2, respectively. The assumption is made in these estimates that there are controls in place to meet State VOC emission limitation requirements.

Table 1. Summary of perchloroethylene (PERC) uses and source emissions in 1983 throughout the United States(a)

Source Category	Baseline Emissions to Atmosphere (Mg/yr)
Production	50
Dry Cleaning(b)	115,000
Metal Degreasing	32,600
Publicly-Owned Treatment Works	2,000
Chemical Plants	245
CFC Production	34
Drinking Water Treatment Facilities	40
Miscellaneous	20,600
Total	171,169

(a)Source: 50 FR 52880.

(b)An average dry cleaning operation with one machine without emission controls emits about 4 Mg/yr of PERC.

Table 2. Summary of trichloroethylene (TCE) uses and source emissions in 1983 throughout the United States(a)

Source Category	Baseline Emissions to Atmosphere (Mg/yr)
Metal Degreasing	52,600
Publicly-Owned Treatment Works	1,450
Production Facilities	102
Chemical Plants	158
Drinking Water Treatment Facilities	42
Miscellaneous(b)	3,300
Total	57,500

(a)Source: 50 FR 52422.

(b)Includes paints and coatings, adhesive formulations, and use as a general solvent.

Section 103(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires any release of PERC to the environment (including the air) that is equal to or greater than one pound in any 24-hour period to be reported to the National Response Center. For TCE, the release should be reported if more than 1,000 pounds are released in any 24-hour period. One megagram per year of solvent is equivalent to about 6 lb/24-hr period.

#### B. EMISSION INVENTORY AND CONTROL MEASURES ADOPTED AT ENERGY SYSTEMS

Energy Systems has been contacted with the intent of:

- Assessing the usage and emissions of PERC and TCE as indicated either by the quantity purchased per year or as reported in the Air Emission Inventory Questionnaire (AEIQ)
- Determining the current status of any emission control technology used, including possibly a description of each system and an indication of its performance level.

Our findings, which are summarized in Table 3, are that the main uses of PERC and TCE at Energy Systems are restricted to Buildings K25, Y12, X10, and to Paducah.

Emission control measures for these two solvents consist of chiller zones above the degreaser tanks to condense the vapors during normal operation and keeping the tanks covered when not in use. The exhaust air flow rate was described as being on the order of several thousands CFM, probably saturated, but no precise value was given.

The use of a chiller zone to minimize emissions is a control measure of limited value, because the exhaust air is still laden with solvent vapors. Other control measures can be prescribed which could allow the recovery of at least 95-98% of the total amount exhausted. Since a great deal of expensive material is currently being lost, installation of an effective control system would result in considerable savings. Savings would continue to be realized, even if another organic solvent were used in place of PERC or TCE in the future.

#### C. CONCLUSIONS

1. Energy Systems is a major user of PERC with an expected usage of 215 Mg/yr, which corresponds to a daily amount of about 1,300 lb, a good fraction of which is released as vapor.

Table 3. Main uses of PERC and TCE at Energy Systems

	K25	Y12	X10	PADUCAH		
TCE (GPY)	—	7	66	1,800	==>	10.4 Mg/yr
(lb/day)		.2	2.2	60		62.4 lb/day
PERC (GPY)	2,600	98,500*	1,600	—	==>	628 Mg/yr
(lb/day)	96	3,643	59			3,798 lb/day

\*About 68,000 gallons were used in M wing in 1985. In December 1985, a large fraction of that usage was eliminated by substituting another type of solvent (either freon or a water/detergent cleaning mixture). Thus, the current consumption of perchloroethylene in Y12 is expected to be only 31,000 gal/yr (1,146 lb/day), which brings the total to 215 Mg/yr (about 1,300 lb/day) for the whole facility.

2. Energy Systems emissions for TCE are 10.4 Mg/yr (62.4 lb/day).
3. Comparison with the overall nationwide levels of emissions shows that the facility usage is 0.126% of the nationwide total and 0.022% of the nationwide total for PERC and TCE, respectively. If the comparison is made with respect to the fraction used for vapor degreasing operations alone, then the values become 0.66% and 0.025%, respectively.
4. Emission control measures at Energy Systems are limited to the use of chiller zones to condense the exhaust fumes from the degreaser tanks.

#### D. RECOMMENDATIONS

1. Annual usage of PERC and TCE at Energy Systems should be compared to annual purchases, and any discrepancy should be accounted for.
2. The merits of emission control measures appropriate for use at Energy Systems should be evaluated. An appropriate system will allow the facility to recover a large fraction of the current losses.

**APPROVAL FOR RELEASE**

Document: # Unnumbered - 1 page ; Date 2/16/79

Title/Subject Letter, TE Bard and DT Duncan to  
VL Turner, USE OF TRICHLOROETHYLENE IN MRDF-CPL  
VAPOR DEGREASERS

Approval for unrestricted release of this document is authorized by the Oak Ridge K-25 Site Classification and Information Control Office, Martin Marietta Energy Systems, Inc., PO Box 2003, Oak Ridge, TN 37831-7307.

*Rubin J. Smith*  
K-25 Classification & Information Control Officer

*2/1/93*  
Date



**NUCLEAR DIVISION**  
INTERNAL CORRESPONDENCE

February 16, 1979

V. L. Turner, 9201-4, MS 001, Y-12 (4-2139)

Use of Trichloroethylene in MRDF-CPL Vapor Degreasers


Equipment specifications numbered YS-2999 and YS-3000 indicate that trichloroethylene is proposed as the operating fluid for the MRDF-CPL vapor degreasers. A letter dated March 22, 1977, to W. W. Thompson from R. D. Gilmore on the subject of "Use of Trichloroethylene in CPDF" addresses the proposed use of trichloroethylene in centrifuge facilities. As mentioned in the letter, animal studies conducted by the National Cancer Institute have implicated trichloroethylene as a potential carcinogen. OSHA, EPA, NIOSH, and ERDA have always supported stringent occupational and environmental control measures for suspected carcinogenic agents and no available information would indicate that trichloroethylene could be exempted from such regulation.

The use of trichloroethylene in any proposed system requires a thorough review of alternate materials to demonstrate that trichloroethylene is the only technically feasible substance with the required characteristics and properties for the proposed use. Documentation of this review must support the exclusive use of trichloroethylene in this facility. Based on current toxicological information, Freon R type solvents would be better agents of choice from industrial hygiene and environmental management standpoints. If a feasible alternative can not be substituted for trichloroethylene, extensive control measures will be necessary to control potential employee exposures. Should you have any questions or comments regarding environmental management, contact T. E. Bard (4-8223) and for industrial hygiene concerns, contact D. T. Duncan (4-8623).

ORIGINAL SIGNED BY

T. E. Bard, K-1551, MS 127 (4-8223)

ORIGINAL SIGNED BY

 D. T. Duncan, K-1003, MS 420 (4-8623)

TEB:DTD:cyw

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# NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

## APPROVAL FOR RELEASE

July 15, 1980

Document: # Unnumbered - 1 page; Date 7/15/80  
Title/Subject Letter, D Milan to JE Vasgaard,

### USE OF TRICHLOROETHYLENE AT ORGDP

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*[Signature]*  
K-25 Classification & Information Control Officer

*7/1/80*  
Date

J. E. Vasgaard, K-1550-F, MS 229

### Use of Trichloroethylene at ORGDP

Trichloroethylene is used as a coolant in many systems at ORGDP, including the operating centrifuge facilities of Separation Systems Development. Letters dated February 16, 1979 and March 1977 by D. T. Duncan and R. D. Gilmore of the Industrial Hygiene Department, respectively, addressed the use of trichloroethylene in proposed centrifuge facilities. These correspondence refer to studies undertaken by the National Cancer Institute (NCI) implicating trichloroethylene as a potential carcinogen. Each letter advises the use of a substitute for trichloroethylene unless it can be demonstrated that trichloroethylene is the only "technically feasible substance with the required characteristics and properties for the proposed use."

The Industrial Hygiene Department was recently requested to evaluate the usage of trichloroethylene as a coolant in the K-1413 desublimator test facility. Upon reviewing the system at K-1413, a recommendation was made to substitute the combine coolant C-816/B-437 for trichloroethylene to provide an added degree of employee protection and to cooperate with efforts within the Union Carbide Corporation to control the use of potential carcinogenic chemicals. Although the C-816/B-437 is being substituted in this particular operation, it should not be regarded as a remedy for all existing or proposed facilities requiring the use of similar coolants. Substantial quantities of C-816/B-437 are stored within the K-25 complex but the chemical is no longer commercially available. Efforts should be initiated to locate a suitable substitute for trichloroethylene other than C-816/B-437 for current or proposed used in K-25 and GCEP.

The Industrial Hygiene Department will evaluate existing usage of trichloroethylene to determine what restrictions, substitutions or workplace practices may be necessary to assure that potential employee exposures are minimized.

Should you have any further questions regarding the usage of trichloroethylene, please contact me directly.

ORIGINAL SIGNED BY

D. Milan, K-303-7, MS 328 (4-8621)

DM:cyw

cc: T. G. Fortney, K-1003, MS 422  
Industrial Hygiene, K-303-7, MS 328

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